

# Obturation of the Root Canal System: An Online Study Guide

## Abstract

The Editorial Board of the *Journal of Endodontics* has developed a literature-based study guide of topical areas related to endodontics. This study guide is intended to give the reader a focused review of the essential endodontic literature and does not cite all possible articles related to each topic. Although citing all articles would be comprehensive, it would defeat the idea of a study guide. Topics covered in this section are obturation materials, the hollow tube theory, termination of the fill, apical control of filling, and obturation techniques. (*J Endod* 2008;34:e37–e43)

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## Introduction

The delivery of high quality clinical care requires a thorough understanding of the endodontic literature. The Editorial Board of the *Journal of Endodontics* has developed this online study guide for endodontists and fellow clinicians interested in endodontics.

There are several potential applications for an online study guide. First, an online study guide permits clinicians to focus in on particular areas of endodontics where they can quickly review key papers devoted to one particular topic. For example, this particular study guide provides a summary of key papers in the area obturation materials, the hollow tube theory, termination of the fill, apical control of filling, and obturation techniques.

Second, a study guide permits speakers to efficiently review background material in preparation for future courses, lectures, or continuing educational events. Third, an online study guide permits students to review key papers in preparation for future examinations or for development of residency seminars. Fourth, an online study guide permits readers to quickly and efficiently access either the abstract or the entire paper cited in the Tables (see Discussion for details).

## Methods

One potential problem in developing an online study guide was to provide a summary of major papers that contributed to a given topic area. The inclusion of all possible papers on a given topic would lead to an unwieldy collection that failed to clearly identify key papers in the area. Of course, exclusion of key papers is also problematic. To address this issue, the *JOE* Editorial Board developed the overall list of topics to be covered and then for each topic generated an initial tabulation of key historical and contemporary papers on that topic. This list was then sent to two outside reviewers who were both experienced educators and Diplomates of the American Board of Endodontics. These reviewers then recommended additions and deletions of papers to the proposed topic list.

To maintain currency, the *JOE* Editorial Board proposes to periodically update each topical study guide by using the same peer-reviewed process as described above.

## Results

The results of the study guide (1-66) provide an overview of selected literature on obturation materials, the hollow tube theory, termination of the fill, apical control of filling, and obturation techniques. This information is organized into [Tables 1-5](#).

## Discussion

The journey to clinical excellence requires not only outstanding clinical skills, but also that special knowledge that accrues from a study of the endodontic literature. The purpose of the *JOE* online study guide is to serve as one source for efficiently reviewing key papers that are organized by topic area and presented with the advantages of online Internet technology.

Although *JOE* readers are undoubtedly familiar with many aspects of the Internet, there are special features available at *JOE* online that provide particular advantages in their application for a study guide. For example, if this particular study guide is downloaded as a pdf, it provides a useful but static listing of the cited articles. On the other hand, if the reader navigates to the Table of Contents page for the Online Study Guide and then clicks on "Full Text" (Fig. 1), they will be taken to an HTML version of the Study Guide. This online version of the study guide has special capabilities including the fact that the references are hyperlinked. Thus, the

## Online Study Guide

reader can quickly obtain abstracts of nearly all cited papers and can review the entire paper of many of the cited papers with only a few clicks of their mouse (Fig. 2). Thus, combining a study guide with online capabilities provides particular benefits for efficiently reviewing key papers in the endodontic literature.

We hope that this Study Guide will prove useful to you as one source for developing a focused and special base of endodontic knowledge. As always, we are interested in your thoughts on this initiative and how the *JOE* can better serve you, our readers. Feel free to email us at: [JEndodontics@UTHSCSA.edu](mailto:JEndodontics@UTHSCSA.edu).

**TABLE 1.** Obturation Materials

Ref #	Title
1.	Rappaport HM, Lilly GE, Kapsimalis P. Toxicity of endodontic filling materials. Oral Surg Oral Med Oral Pathol 1964;18:785-802.
2.	Spangberg L, Langeland K. Biologic effects of dental materials: 1—toxicity of root canal filling materials on HeLa cells in vitro. Oral Surg Oral Med Oral Pathol 1973;35:402-14.
3.	Goodman A, Schilder H, Aldrich W. The thermomechanical properties of gutta-percha: II—the history and molecular chemistry of gutta-percha. Oral Surg Oral Med Oral Pathol 1974;37:954-61
4.	Friedman CM, Sandrik JL, Heuer MA, Rapp GW. Composition & mechanical properties of gutta-percha endodontic points. J Dent Res 1975;54:921-5.
5.	Friedman CE, Sandrik JL, Heuer MA, Rapp GW. Composition and physical properties of gutta-percha endodontic filling materials. J Endod 1977;3:304-8.
6.	Sorin SM, Oliet S, Pearlstein F. Rejuvenation of aged (brittle) endodontic gutta-percha cones. J Endod 1979;5:233-8.
7.	Orstavik D. Materials used for root canal obturation: technical, biological and clinical testing. Endo Topics 2005;12:25-38.
8.	Dahl JE. Toxicity of endodontic filling materials. Endo Topics 2005;12:39-43.
9.	Merdad K, Pascon A, Kulkarni G, Santerre P, Friedman S. Short-term cytotoxicity assessment of components of the epiphany resin-percha obturating system by indirect and direct contact Millipore filter assays. J Endod 2007;33:24-7.

**TABLE 2.** Hollow Tube Theory

Ref #	Title
10.	Rickert UG, Dixon CM. The controlling of root surgery. Internat Dent Congress (8th) Tr Suppl, 1931;Sec IIIa: 15-22.
11.	Torneck CD. Reaction of rat connective tissue to polyethylene tube implants, Part I. Oral Surg Oral Med Oral Pathol 1966;21:379-87.
12.	Torneck CD. Reaction of rat connective tissue to polyethylene tube implants, part II. Oral Surg Oral Med Oral Pathol 1967;24:674-83.
13.	Sabeti MA, Nekofar M, Motahhary P, Ghandi M, Simon JH. Healing of apical periodontitis after endodontic treatment with and without obturation in dogs. J Endod 2006;32:628-33.

**TABLE 3.** Termination of the Fill

Ref #	Title
14.	Grahn H, Hansson L. The prognosis of pulp and root canal therapy: a clinical and roentgenographic follow-up examination. <i>Odont Revy</i> 1961;12:146-65.
15.	Seltzer S, Bender IB, Turkenkopf S. Factors affecting successful repair after root canal therapy. <i>J Am Dent Assoc</i> 1963;67:651-62.
16.	Davis MS, Joseph SW, Bucher JF. Periapical and intracanal healing following incomplete root canal fillings in dogs. <i>Oral Surg Oral Med Oral Pathol</i> 1971;31:662-75.
17.	Seltzer S, Soltanoff W, Smith J. Biologic aspects of endodontics: V—periapical tissue reactions to root canal instrumentation beyond the apex and root canal fillings short of and beyond the apex. <i>Oral Surg Oral Med Oral Pathol</i> 1973;36:725-37.
18.	Swartz DB, Skidmore AE, Griffin JA Jr. Twenty years of endodontic success and failure. <i>J Endod</i> 1983;9:198-202.
19.	Ricucci D. Apical limit of root canal instrumentation and obturation part 1: literature review. <i>Int Endod J</i> 1998;31:384-93.
20.	Ricucci D. Apical limit of root canal instrumentation and obturation part 2: a histological study. <i>Int Endod J</i> 1998;31:394-409.

**TABLE 4.** Apical Control of Filling

Ref #	Title
21.	Coviello, J, Brilliant JD. A preliminary clinical study on the use of tricalcium phosphate as an apical barrier. <i>J Endod</i> 1979;5:6-13.
22.	Holland R, DeSouza V, Nery MJ, deMello W, Bernabe PFE, Otoboni Filho JA. Tissue reactions following apical plugging of the root canal with infected dentin chips: a histologic study in dogs' teeth. <i>Oral Surg Oral Med Oral Pathol</i> 1980;49:366-9.
23.	Rossmesl R, Reader A, Melfi R, Marquard J. A study of freeze-dried (lyophilized) cortical bone used as an apical barrier in adult monkey teeth. <i>J Endod</i> 1982;8:219-26.
24.	ElDeeb ME, Thuc-Quyen NT, Jensen JR. The dentinal plug: its effect on confining substances to the canal and on the apical seal. <i>J Endod</i> 1983;9:355-9.
25.	Pitts DL, Jones JE, Oswald RJ. A histological comparison of calcium hydroxide plugs and dentin plugs used for the control of gutta-percha root canal filling material. <i>J Endod</i> 1984;10:283-93.
26.	Jacobsen EL, Bery PF, BeGole EA. The effectiveness of apical dentin plugs in sealing endodontically treated teeth. <i>J Endod</i> 1985;11:289-93.
27.	Weisenseel JA, Hicks ML, Pelleu GB. Calcium hydroxide as an apical barrier. <i>J Endod</i> 1987;13:1-5.
28.	Augsburger RA, Peters DD. Radiographic evaluation of extruded obturation materials. <i>J Endod</i> 1990;16:492-7.

**TABLE 5.** Obturation Techniques

Ref #	Title
29.	Marshall FJ, Massler, M. The sealing of pulpless teeth evaluated with radioisotopes. J Dent Med 1961;16:172-84.
30.	Schilder H. Filling root canals in three dimensions. Dent Clin North Am 1967;11:723-44.
31.	Knapp JP, Marshall FJ. Custom fitting of standardized gutta-percha master cones. Dent Digest 1972;78:348-52.
32.	Wollard RR, Brough SO, Maggio J, Seltzer S. Scanning electron microscopic examination of root canal filling materials. J Endod 1976;2:98-110.
33.	Larder TC, Prescott AJ, Brayton SM. Gutta-percha: a comparative study of three methods of obturation. J Endod 1976;2:289-94.
34.	Yee FS, Marlin J, Krakow AA, Gron P. Three-dimensional obturation of the root canal using injection-molded, thermoplasticized dental gutta-percha. J Endod 1977;3:168-74.
35.	Russin TP, Zardiackas LD, Reader A, Menke RA. Apical seals obtained with laterally condensed, chloroform-softened gutta-percha and laterally condensed gutta-percha and Grossman's sealer. J Endod 1980;6:678-82.
36.	Wong M, Peters DD, Lorton L. Comparison of gutta-percha filling techniques, compaction (mechanical), vertical (warm), and lateral condensation techniques, Part I. J Endod 1981;7:551-8.
37.	Allison DA, Michelich RJ, Walton RE. The influence of master cone adaptation on the quality of the apical seal. J Endod 1981;7:61-5.
38.	Marlin J, Krakow AA, Desilets RP, Gron P. Clinical use of injection-molded thermoplasticized gutta-percha for obturation of the root canal system: a preliminary report. J Endod 1981;7:277-81.
39.	Brothman P. A comparative study of the vertical and the lateral condensation of gutta-percha. J Endod 1981;7:27-30.
40.	Wong M, Peters DD, Lorton L, Bernier WE. Comparison of gutta-percha filling techniques: three chloroform - gutta-percha filling techniques, Part II. J Endod 1982;8:4-9.
41.	Keane KM, Harrington GW. The use of a chloroform-softened gutta-percha master cone and its effect on the apical seal. J Endod 1984;10:57-63.
42.	Michanowicz A, Czonstkowsky M. Sealing properties of an injection-thermoplasticized low-temperature (70°C) gutta-percha: A preliminary study. J Endod 1984;10:563-6.
43.	EiDeeb ME. The sealing ability of injection-molded thermoplasticized gutta-percha. J Endod 1985;11:84-6.
44.	Morse DR, Mann C, Esposito JV. Gutta-percha/Eucapercha, Part I: characteristics and an update of the technique. Compendium 1987;8:708-17.
45.	Morse DR, Mann C, Esposito JV. Gutta-percha/Eucapercha, Part II: indications, representative cases, and pitfall management. Compendium 1987;8:772-7.
46.	Beatty RG, Baker PS, Haddix J, Hart F. The efficacy of four root canal obturation techniques in preventing apical dye penetration. J Am Dent Assoc 1989;119:633-7.
47.	Smith JJ, Montgomery S. A comparison of apical seal: chloroform versus halothane-dipped gutta-percha cones. J Endod 1992;18:156-60.
48.	Weine FS. A preview of the canal-filling materials of the 21st century. Compendium 1992;13:688-97.
49.	Juhlin JJ, Walton RE, Dovgan JS. Adaptation of thermafil components to canal walls. J Endod 1993;19:130-5.
50.	Dickson SS, Peters DD. Leakage evaluation with and without vacuum of two gutta-percha fill techniques. J Endod 1993;19:398-403.

TABLE 5. (Continued)

Ref #	Title
51.	Gutmann JL, Saunders WP, Saunders EM, Nguyen L. An assessment of the plastic Thermafil obturation technique: Part 2—material adaptation and sealability. <i>Int Endod J</i> 1993;26:179-83.
52.	Smith RS, Weller RN, Loushine RJ, Kimbrough WF. Effect of varying the depth of heat application on the adaptability of gutta-percha during warm vertical compaction. <i>J Endod</i> 2000;26:668-72.
53.	Clinton K, Himel VT. Comparison of a warm gutta-percha obturation technique and lateral condensation. <i>J Endod</i> 2001;27:692-5.
54.	Guess GM, Edwards KR, Yang ML, Igbal MK, Kim S. Analysis of continuous-wave obturation using a single-cone and hybrid technique. <i>J Endod</i> 2003;29:509-12.
55.	Shipper G, Trope M. In vitro microbial leakage of endodontically treated teeth using new and standard obturation techniques. <i>J Endod</i> 2004;30:154-8.
56.	Shipper G, Orstavik D, Teixeira FB, Trope M. An evaluation of microbial leakage in roots filled with a thermoplastic synthetic polymer-based root canal filled material (Resilon). <i>J Endod</i> 2004;30:348-51.
57.	Lea CS, Apicella MJ, Mines P, Yancich PP, Parker MH. Comparison of the obturation density of cold lateral compaction versus warm vertical compaction using the continuous wave of condensation technique. <i>J Endod</i> 2005;31:37-9.
58.	Shipper G, Teixeira FB, Arnold RR, Trope M. Periapical inflammation after coronal microbial inoculation of dog roots filled with gutta-percha or resilon. <i>J Endod</i> 2005;31:91-6.
59.	Whitworth J. Methods of filling root canals: principles and practice. <i>Endo Topics</i> 2005;12:2-24.
60.	Epley SR, Fleischman J, Hartwell G, Cicalese C. Completeness of root canal obturations: Epiphany techniques versus gutta-percha techniques. <i>J Endod</i> 2006;32:541-4.
61.	Biggs SG, Knowles KI, Ibarrola JL, Pashley DH. An in vitro assessment of the sealing ability of Resilon/Epiphany using fluid filtration. <i>J Endod</i> 2006;32:759-61.
62.	Collins J, Walker MP, Kulild J, Lee C. A comparison of three gutta-percha obturation techniques to replicate canal irregularities. <i>J Endod</i> 2006;32:762-5.
63.	Brackett MG, Martin R, Sword J, et al. Comparison of seal after obturation techniques using a polydiamethylsiloxane-based root canal sealer. <i>J Endod</i> 2006;32:1188-90.
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65.	Tay FR, Pashley DH. Monoblocks in root canals: a hypothetical or a tangible goal. <i>J Endod</i> 2007;33:391-8.
66.	Karr NA, Baumgartner JC, Marshall JG. A comparison of gutta-percha and resilon in the obturation of lateral grooves and depressions. <i>J Endod</i> 2007;33:749-52.

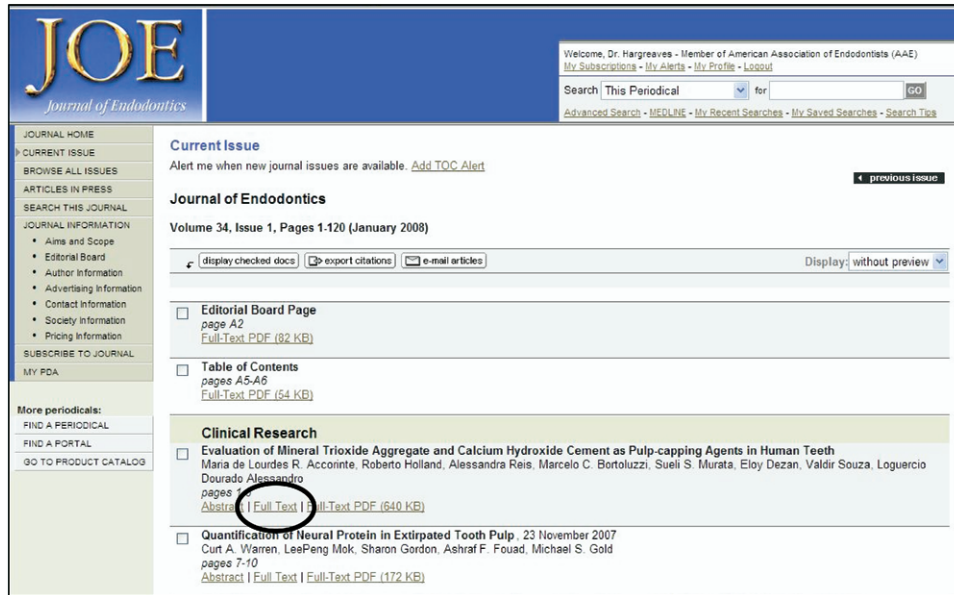


Figure 1. Navigation to HTML version.

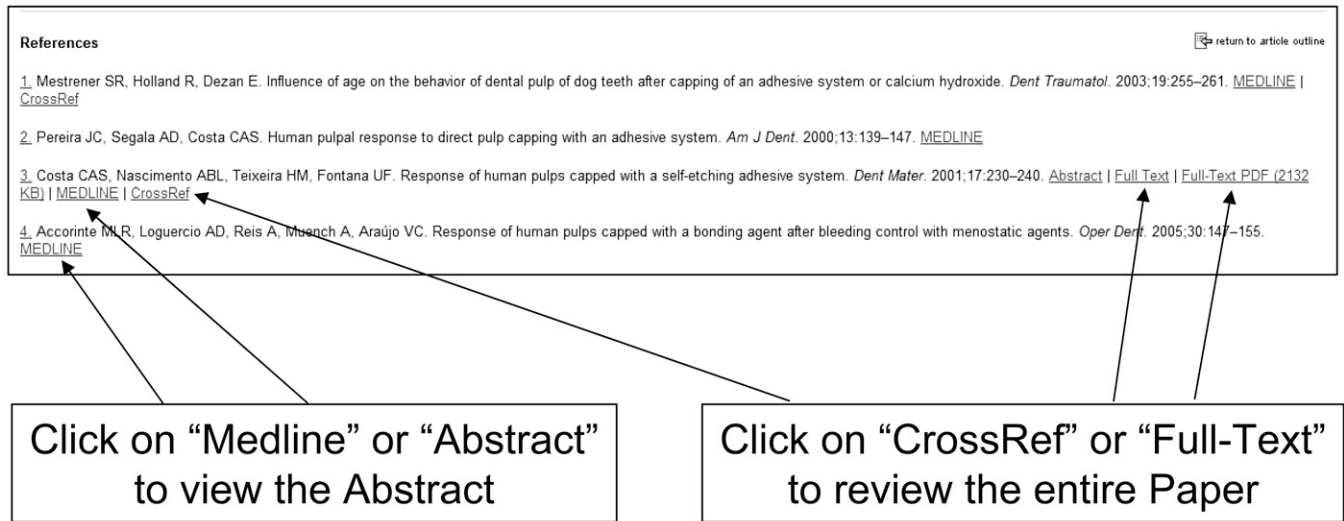


Figure 2. Hyperlink to References.

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